

Feb.12, 2021

**Tools to convert an AR-IQ3 recording made with the AR5700D receiver, to make it compatible with GNU RADIO on WINDOWS.**

**GNU Radio is a free & open-source software development toolkit that provides signal processing blocks to implement software radios.**

**Also works with recordings made via AR2300 / AR5001D / AR6000 equipped with the IQ5001 option.**

**Tested and confirmed to work on:** Windows 10

It is very likely to work on WIN 7 and 8.1 as well, maybe with some slight differences. The best way to know is to try it out yourself!

**Required Windows knowledge:** Medium

You must be comfortable with operating the AR-IQ3 software, running scripts via the command prompt, and have basic knowledge about signal processing principles.

AR5700D, AR2300 / AR5001D / AR6000 + IQ5001 will simply be described as "receiver".

#### **<supplied files>**

\* OOREADME.txt --- Japanese instructions

\* ariq3\_to\_rawIQ.py --- Python script to convert an AR-IQ3 wav (I/Q) recording for GNU Radio (WIN) compatibility

\* iq\_IntInput.grc, iq\_IntInput.py, grc-sample.png --- Sample GNU Radio (WIN) files (Minimum required version to load this grc file is 3.8. For version 3.7, build the blocks as depicted on grc-sample.png)

#### **<How to use>**

##### **1. Preparations**

###### **1.1**

An updated Windows 10 system with AR-IQ3 installed and ready to use, and a receiver connected to the PC via two USB cables.

###### **1.2**

Unzip "IQ\_for\_GNURadio\_Windows\*\*\*.zip" to your desktop. (You can unzip it to any directory you like, however the instructions here are based on the desktop location)

###### **1.3**

Install following software:

Gnu Radio (v3.8 or newer) for Windows. Binary installer download page: <http://www.gcndevelopment.com/gnuradio/index.htm>

##### **2. Record I/Q data**

###### **2.1**

For your first test via the supplied GNU Radio template (iq\_IntInput.grc), make a short FM broadcast (I/Q) recording with AR-IQ3, as described in the receiver manual. Once the recording is made, the receiver is not required anymore and you can also disconnect the USB cables.

###### **2.2**

Copy the I/Q data to the "IQ for GNURadio Windows" folder you created in step 1.2. (You can copy it to any folder you like, however the instructions here are based on that location)

### 3. Convert the I/Q data

(There are many ways to run a Python script, the below is just one example.)

Open a command prompt (Type cmd in the search box, then press Enter to open the highlighted Command Prompt shortcut.)

You will see something like this:

```
C:\Users\AOR>          (“AOR” will obviously be something else on your PC)
```

Now you have to change the current working directory to the “IQ for GNURadio Windows” folder on your desktop. Type as follows:

```
cd C:\Users\AOR\Desktop\IQ for GNURadio Windows
```

Press Enter

You will then see:

```
C:\Users\AOR\Desktop\IQ for GNURadio Windows>
```

Now we will run the supplied Python script “ariq3\_to\_rawIQ.py” to convert your I/Q recording which is “REC\_000.wav” in this example. Type:

(We assume here GNU Radio is installed in its default directory.)

```
“C:\Program Files\GNURadio-3.8\tools\python3\python.exe” ariq3_to_rawIQ.py REC_000.wav
```

Press Enter

Be patient as the conversion process can take a while, about 90 seconds for 400MB recording on an Intel I5 system.

Once done, the following two files will be created in your “IQ for GNURadio Windows” folder:

REC\_000\_transI.raw

REC\_000\_transQ.raw

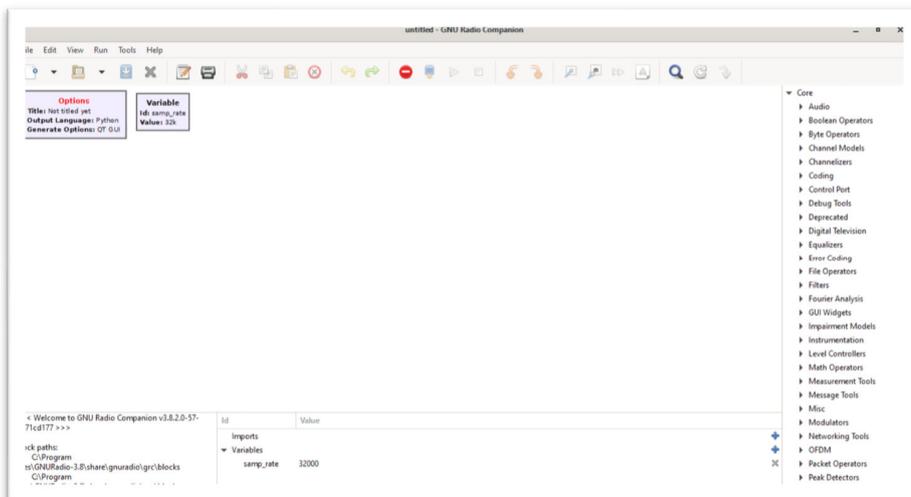
These are the two files to be used in GNU Radio for Windows.

### 4. Run GNU Radio

Double click the GNU Radio icon on your desktop.

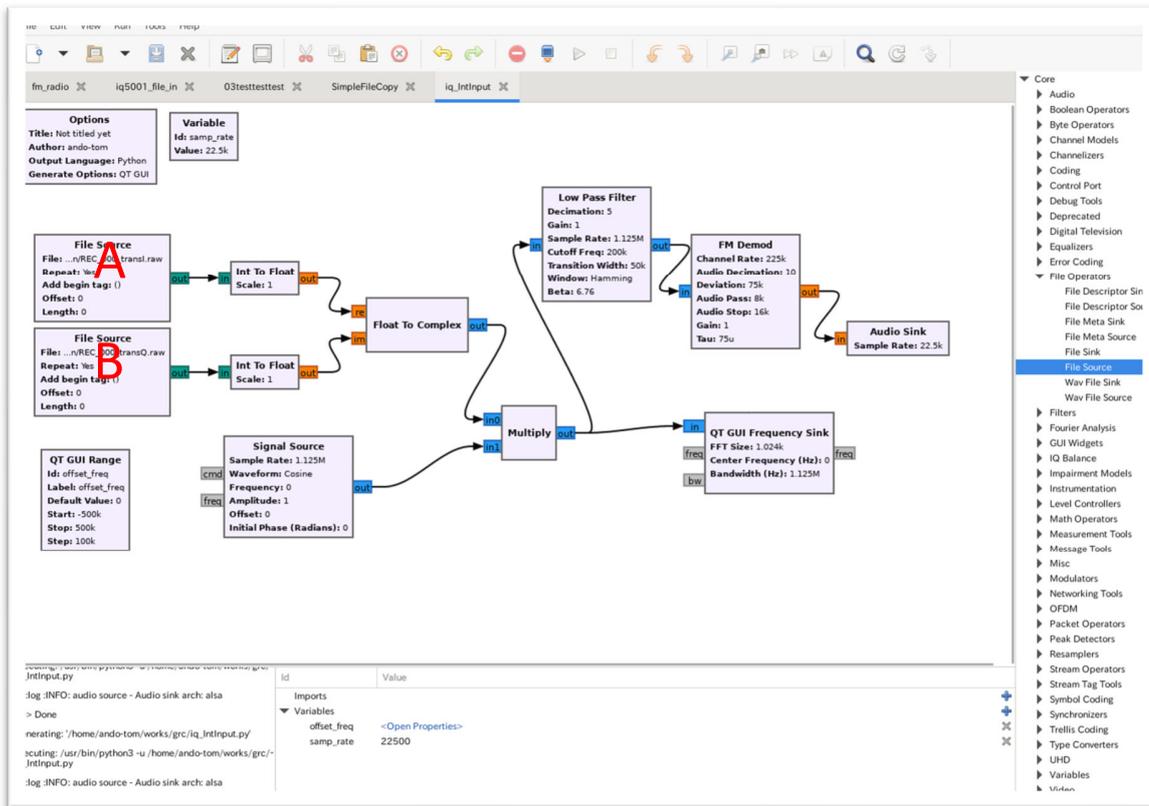
It will take about a minute to start. You can ignore the scary warnings in command prompt but you have to keep that black window open for GNU Radio to function.

GNU Radio opened for the 1<sup>st</sup> time:



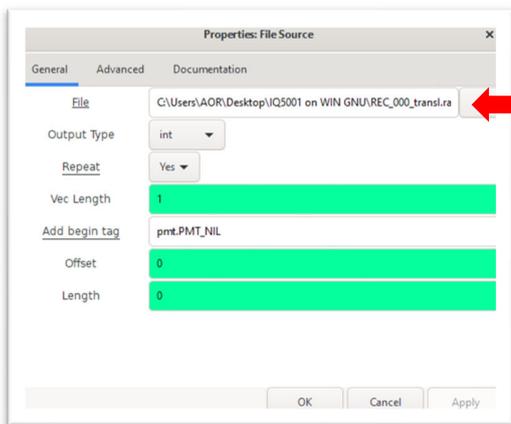
Now go to FILE > OPEN and open the supplied template “iq\_IntInput.grc” located in the “IQ for GNURadio Windows” folder on your desktop.

It will look like this:



You are almost done. The last thing to do is to teach GNU Radio where you have placed your converted \*.raw files.

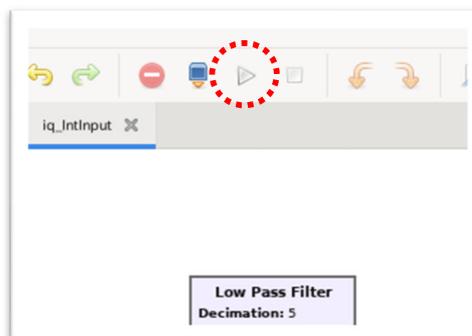
Right click the FILE SOURCE block marked "A" and select PROPERTIES.



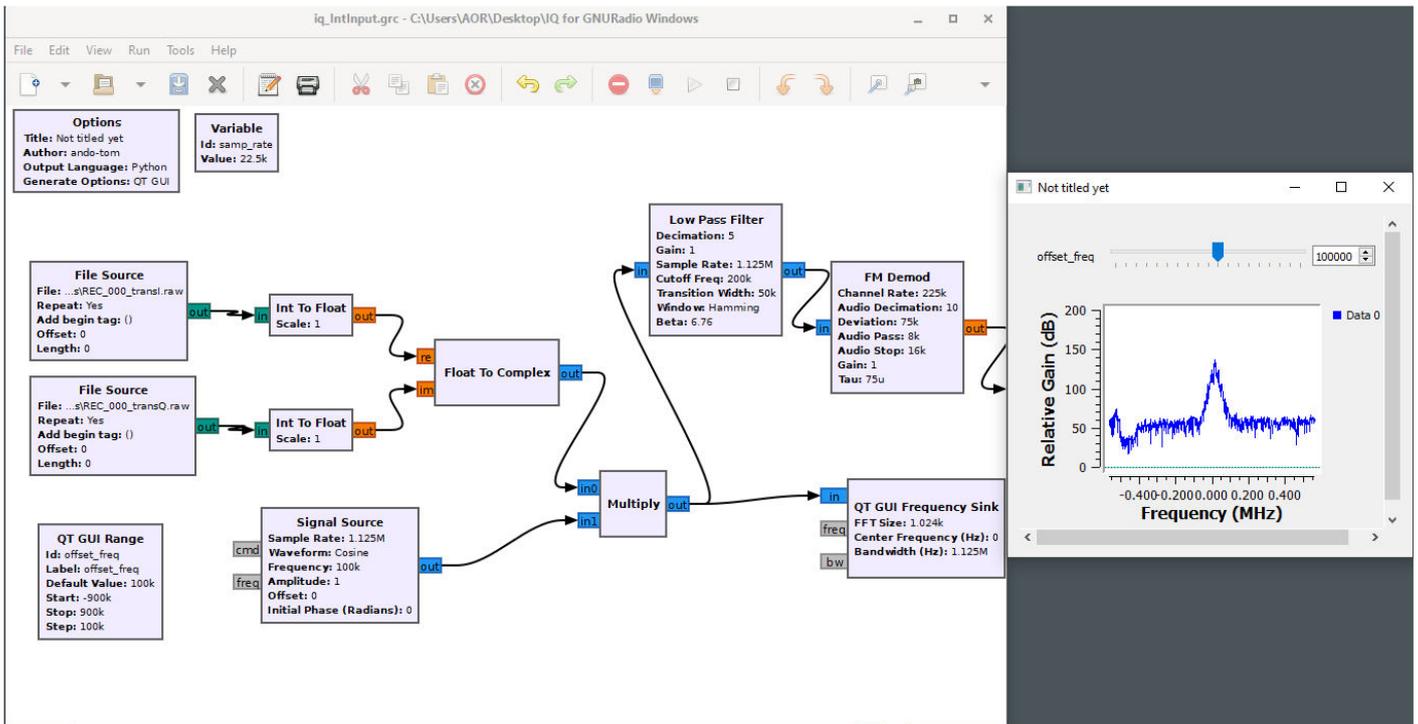
Click the box marked by the red arrow and select the "REC\_000\_transl.raw" file.

Now proceed likewise for the FILE SOURCE block marked "B" and select the "REC\_000\_transQ.raw" file.

You can now activate the template by clicking the play button:



You should now hear the FM broadcast audio, and see the spectrum display being played back as follows:



## 5. What next?

The supplied GNU Radio template is just a demonstration of the numerous and exciting things which can be done with an I/Q source file in GNU Radio.

If you want to learn more, visit the official GNU Radio website at <https://www.gnuradio.org/>. They have numerous tutorials and a very extensive documentation available.

Have fun experimenting!

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